



Product summary

Ultrastar 36XP

Multi-mode SE/LVD



Models: DRHS-36V
DRHS-36D

Introducing

IBM's new Ultrastar 36XP offers a 36.4GB capacity in multi-mode Low Voltage Differential (Ultra2 SCSI). With advanced disk drive technologies such as S.M.A.R.T., No-ID sector formatting, the Drive Temperature Indicator (Drive-TIP) feature, and a programmable, multi-segmented 4.0MB cache, the 36XP provides outstanding performance and reliability with superior storage capacity.

Applications

- Technical/commercial workstations
- Network servers
- High-end personal computers
- Video editing
- Multimedia
- Data mining applications

Features

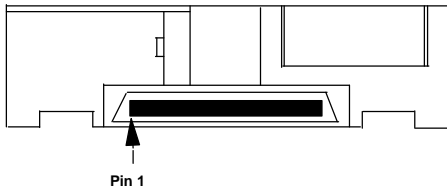
- 36.4GB formatted capacity
- Industry standard interface
 - 68 pin Ultra2 SCSI Fast Wide
 - 80 pin Ultra2 SCSI SCA-2
- 11.7 - 19.9MB/sec sustained data transfer rate
- 17.7 - 28.9 peak media transfer rate
- Average seek time 7.5ms (typical read)
- Latency 4.17ms
- 4MB programmable multi-segmented cache buffer
- Low command overhead
- ECC on the fly (EOTF)
- Magnetoresistive Extended Head technology
- No-ID sector formatting
- PRML data channel
- Predictive Failure Analysis (S.M.A.R.T. compliant)
- Drive Temperature Indicator Processor (Drive-TIP) feature

Benefits

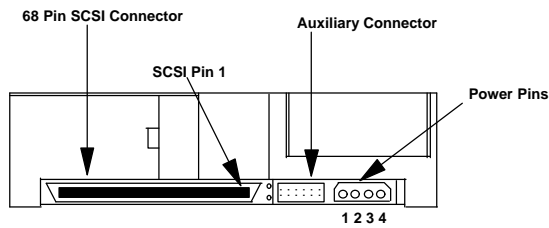
- Superior storage capacity
- Fast interface data rates
 - 40 & 80MB/sec
 - 40 & 80MB/sec
- High data rate across entire disk surface
- Fast access to data
- Fast data retrieval in single and multi-tasking applications
- Improved data throughput
- High areal density
- More data stored per track, increased sustained data transfer rate
- High reliability and availability

Connectors

The electrical connectors are located as shown.

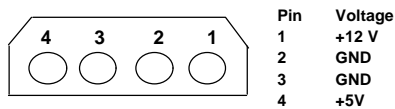


Electrical connectors (rear view) 80 pin SCA models.



Electrical connectors (rear view) 68 pin models.

Power pin assignment of 68 pin models is shown below.

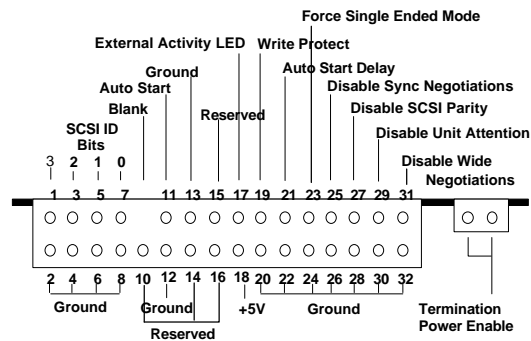


The 68 pin models use a Molex connector (PN 87360-0001) compatible with the ANSI SCSI "P" connector. The 80 pin SCA-2 models use an AMP connector (PN 5-917593-9) compatible with Annex D of the SCSI Parallel Interface-2 (SPI-2) specification. Placement of the connector complies with the Small Form Factor Committee document, "SFF-8337 Specification for SCA-2 Connector Location" Revision 1.2.

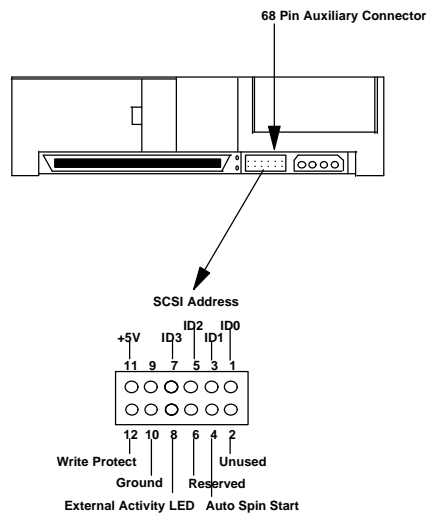
Option block

Jumper settings

The Ultrastar 36XP models contain a jumper block that can be used to enable certain features and to select the SCSI ID of the drive. This jumper block is referred to as the "Front" Option Jumper Block due to its location on the drive.



Note: 80 pin models do not have Termination Power Enable.



Jumper setting descriptions

Note: In the address determination table, “off” means a jumper is not in place and “on” means a jumper is in place.

Bit 3	Bit 2	Bit 1	Bit 0	Address
off	off	off	off	0
off	off	off	on	1
off	off	on	off	2
off	off	on	on	3
off	on	off	off	4
off	on	off	on	5
off	on	on	off	6
off	on	on	on	7
on	off	off	off	8
on	off	off	on	9
on	off	on	off	10
on	off	on	on	11
on	on	off	off	12
on	on	off	on	13
on	on	on	off	14
on	on	on	on	15

Auto Start (and Delay) pins

The Auto Start and Auto Start Delay pins control when and how the drive can spin up and come ready. When configured for Auto-Startup, the motor spins up after power is applied without the need of a SCSI Unit Start command. For no Auto-Startup, a SCSI Unit Start command is required to make the drive spin and be ready for media access operations. When in Auto-Startup mode, the drive will delay its start time by a period of time multiplied by its own SCSI address.

External Activity (LED) pins

The LED pins can be used to drive an external Light Emitting Diode. Please refer to the LED pin section of the Ultrastar 36XP Parallel SCSI Disk Drive Logical Interface Specification for a detailed functional description of this pin.

Write Protect pin

If the Write Protect pin is jumpered to ground, SCSI commands that alter the customer data area portion of the media are prohibited from being performed. The state of this pin is monitored on a per

command basis. See the Ultrastar 36XP Parallel SCSI Disk Drive Logical Interface Specification for functional details.

Disable Synchronous Negotiation pin

If a Disable Target Initiated Synchronous Negotiation pin is grounded, then an Initiator is required to start a negotiation handshake if Synchronous and/or “wide” (double byte) SCSI transfers are desired. Please refer to the Ultrastar 36XP Parallel SCSI Disk Drive Logical Interface Specification for functional details.

Disable SCSI Parity pin

Grounding this pin will disable SCSI Parity checking.

Disable Unit Attention pin

Grounding this pin will disable the drive from building Unit Attention Sense information for commands immediately following a Power On Reset (POR) or SCSI Bus Reset. Any pending Unit Attention conditions will also be cleared at POR or SCSI Reset times.

Disable Wide Negotiations

Jumpering the pins will cause the drive to operate in single byte mode. The drive will not negotiate “wide” (double byte) operation.

Force Single-Ended Mode

Jumpering pin #23 to pin #24 will cause all models to operate in Single-Ended mode only. The drive will not use the DIFFSENS line to determine SE or LVD modes.

Data organization

All models

Number of disks	10
Number of heads	20

Seek times (in milliseconds)

Single cylinder	Read	0.30ms
	Write	0.90ms
Average (weighted)	Read	7.50ms
	Write	8.50ms
Full stroke (typical)	Read	14.5ms
	Write	15.7ms

User capacities for several block lengths

512	36,954,401,790
514	36,804,921,684
520	36,434,947,120
522	36,492,490,692
524	36,521,964,744
528	36,556,040,928
536	36,522,582,256
688	37,791,706,528
732	38,184,550,152

DC power requirement limits

The following voltage specifications apply at the drive power connector. There is no special power on/off sequencing required.

Power supply current (in Amps)

	Pop. mean	Pop. max.
+5VDC (Power Save mode ¹)	0.55 ²	
+5VDC (Idle)	0.77	
+5VDC (R/W baseline)	0.93	
+5VDC (R/W pulse)		1.32
+12VDC (Power Save mode)	0.72	
+12VDC (Idle)	0.71	
+12VDC (Seek Peak)		2.3
+12VDC (Start)		2.7 ³

Notes:

1. Power save mode is automatically invoked after 1 second of inactivity, except when read ahead is active, in which case power save mode is invoked after 40 seconds of inactivity.

2. 5V current is given with termination power provided by the using system if required.
3. The start current is the total 12 V current required by the drive.

Generated ripple at drive power connector

	Maximum	Frequency
+5V DC	250mV P-to-P	0-20 MHz
+12VDC	650mV P-to-P	0-100 Hz
+12VDC	400mV P-to-P	100-5,000 Hz
+12VDC	250mV P-to-P	5 KHz-20 MHz

During drive start up and seeking, 12 volt ripple is generated by the drive (referred to as dynamic loading). If several drives have their power supply daisy chained together, the power supply ripple plus other drives' dynamic loading must remain within the regulation tolerance window of ±5%. A common supply with separate power leads to each drive is a more desirable method of power distribution.

Hot Plug/Unplug support

The term "Hot Plug" refers to the action of mechanically engaging a device to power and/or SCSI bus when other devices may be active on the same bus.

During Hot Plug events the non-operational shock levels should not be exceeded. The operational shock levels of adjacent drives should also not be exceeded. The recommended procedure is to prohibit write operations to adjacent drives during the Hot Plug and during the Hot Unplug actions. During Hot Unplug the operational shock limit specifications should not be exceeded. If this cannot be guaranteed then the drive should

be issued a SCSI Stop Unit command that is allowed to complete before unplugging. The recommended procedure is to allow the unplugged drive to rest in the drive bay for a minimum of 15 seconds and then complete the removal.

During Hot Plug or Unplug events the power supply ripple on adjacent operational drives should not go outside of the ±5% regulation tolerance.

SCSI bus cable

Low Voltage differential models permit cable lengths of up to 12 meters (39.37 feet) when operating in LVD mode. Cables must meet the requirements for LVD cables as set forth in the Information Technology SCSI Parallel 2 (SPI-2) standard under "Cable Requirements".

In Single-Ended SCSI mode, cable lengths of up to 6 meters (19.69 feet) are permitted. It should be noted however that users who plan to use "Fast" data transfers with Single-Ended models should follow all of the ANSI SCSI guidelines for Single-Ended "Fast" operations. This may include a cable length of less than 6 meters.

When operating in Fast-20 mode cable lengths of 3 meters (9.84 feet) are supported.

SCA-2 connector models are not designed for direct cable attachment due to the combination of power and SCSI bus signals. "Fast" data transfers with SCA models should follow all of the ANSI SCSI guidelines for Single-Ended "Fast" operations.

The ANSI SCSI standard states that any stub from the main cable

must not exceed 0.1 meters for Single-Ended or LVD cables. The Ultrastar 36XP has a maximum internal stub length of 0.06 meters on all LVD and "single-ended" SCSI signals. To remain compliant with the standard, the SCSI bus cable must not add more than 0.05 meters additional stub length to any of the LVD and Single-Ended SCSI signals.

SCSI bus terminators

The using system is responsible for making sure that all required signals are terminated at both ends of the cable. There is no active termination supplied on the Ultrastar 36XP drives. Termination must be provided externally. Some external terminator possibilities for 68 pin models are the Data Mate DM2750-01-LVD (LVD Only) and the Amphenol 497040001 (Multi-mode).

Operating environment

The drive operates within its performance limits when the following environment is maintained.

Operating conditions

Temperature	5 to 50°C (41 to 122°F) ambient 5 to 65°C (41 to 149°F) disk enclosure
Temperature gradient	20°C (36°F) per hour
Humidity	5% to 90% (time-average)
Wet Bulb Temperature	26.7°C (80°F) maximum
Elevation	-304.8 to 3048 meters (-1000 to 10,000 feet)

Non-operating conditions

Temperature	1 to 60°C (34 to 149°F) storage -40 to 60°C (-40 to 149°F) shipping
Temperature gradient	below condensation
Humidity	5% to 90% (time-average) storage 5% to 95% (applies at packaged level) shipping
Wet Bulb temperature	29.4°C (85°F) maximum
Elevation	-304.8 to 12,192 meters (-1000 to 40,000 feet) shipping -304.8 to 3048 meters (-1000 to 10,000 feet) storage

Start and stop times

Bring-up sequence times (seconds)

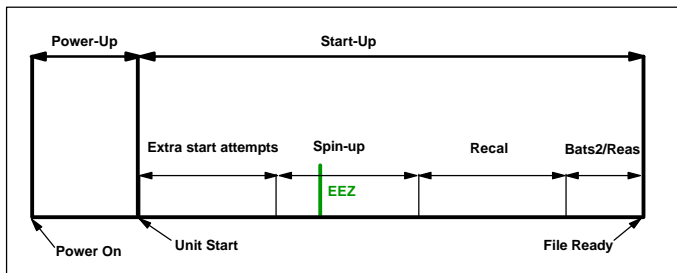
	Nominal	Worst Case
Power-Up	2.5	3
Start attempts	0	4.6
Spin-Up	10.5	14
Servo Recal	9.9	9.5
Bats2 /Reassign	0.5	1
Start-Up Time	20.9	29.1

Note: Worst Case represents a 3-sigma event.

Bring-up sequence times and stop times

See chart below.

Note: If a SCSI Reset is issued while the drive is in either a Power-Up or Start-Up sequence, that same sequence starts again.



In all other cases when a SCSI Reset is issued the present state of the motor is not altered.

Note: A start-up sequence initiated by a SCSI "Start/Stop Unit" command that follows a spindle stop initiated by a SCSI "Start/Stop Unit" command by less than 10 seconds may result in the start-up sequence increasing by as much as 10 seconds. For example, if a delay of only 3 seconds exists between the two commands the second command takes 7 seconds longer than if 10 seconds or more had been allowed between the commands.

Vibration and shock

Operating/non-operating vibration

Due to the complexity of this subject, it is recommended that customers contact their IBM representatives for further information on this subject.

Operating shock

No hard errors will occur to the drive when subjected to a 10G half sine wave shock pulse of 2 ms duration.

The shock pulses are applied in each of three mutually perpendicular axes, one axis at a time.

Non-operating shock

No hard errors will occur if the unpackaged drive is subjected to a 20 ms square pulse shock of 35Gs or less to all three axes, one direction at a time.

No hard errors will occur if the unpackaged drive is subjected to a 180 inches per second velocity change square pulse shock of 50Gs or less to all three axes, one direction at a time.

No hard errors will occur if the unpackaged drive is subjected to a 2 ms half sine wave shock of 140 Gs or less to all three axes, one direction at a time.

Rotational shock

The actuator will remain latched in the disk landing zone if the unpackaged drive is subjected to a 2 ms half sine wave shock less than 15,000 radians per second squared applied to the XY plane.

Acoustics

5.0 LwA idle.
5.5 LwA operating.

Acoustic degradation resulting from non-operating shock

No degradation in A-weighted idle sound power will occur if the unpackaged drive is limited to a 2 ms half sine pulse shock of 70 Gs or less applied in the axial direction (z axis), or 150 Gs or less applied in the radial direction (x-y plane). The average A-weighted idle sound power will increase by 0.3 Bels if the unpackaged drive is subjected to a 2ms half sine pulse shock of 110 Gs applied in the axial direction (z axis), or 210 Gs applied in the radial direction (x-y plane).

Electromagnetic compatibility

When installed in a suitable enclosure and exercised with a random accessing routine at maximum data rate, this drive meets the worldwide EMC requirements listed below.

- FCC Requirements: United States Federal Communications Commission (FCC) Rules and Regulations, Subpart B Digital Devices "Class A and B Limits".
- CISPR 22 Requirements: Comite International Special des Perturbations Radio Electriques (International Special Committee on Radio Interference) "Class A and B Limits".
- European Declaration of Conformity: This drive has been tested to comply with the European Council Directive 89/336/EEC and thereby bears the "CE" Mark of Conformity.

- Australian Declaration of Conformity: This drive has been tested to comply with AS/NZS 3548 and thereby bears the "C-Tick" Mark of Conformity.

Mechanical specifications

Physical dimensions

	SI Metric	US
Weight	1.08 kg	2.38 lb
Height	41.00 mm	1.61 in
Width	101.85 mm	4.00 in
Depth	147.00 mm	5.79 in

Notes:

- These are nominal weights and dimensions provided for reference only.
- The weight tolerance is $\pm 10\%$. Card interface types and disk quantity determine the weight variability.

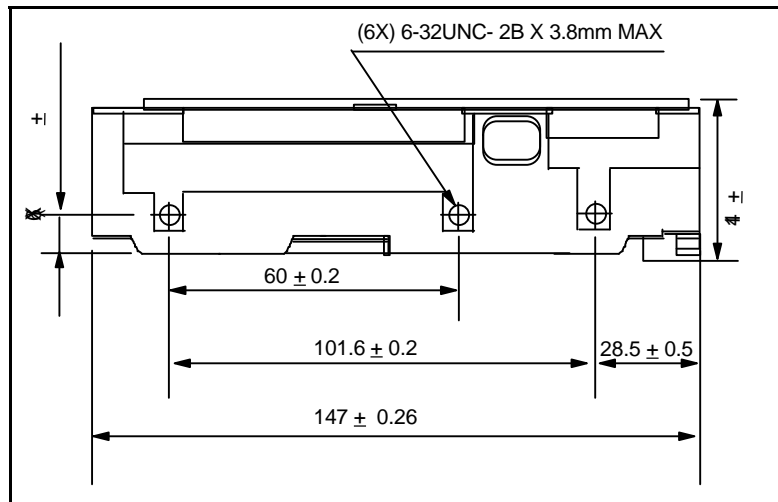
Clearances

A minimum of 2 mm clearance should be given to the bottom surface except for a 10 mm maximum diameter area around the bottom mounting holes.

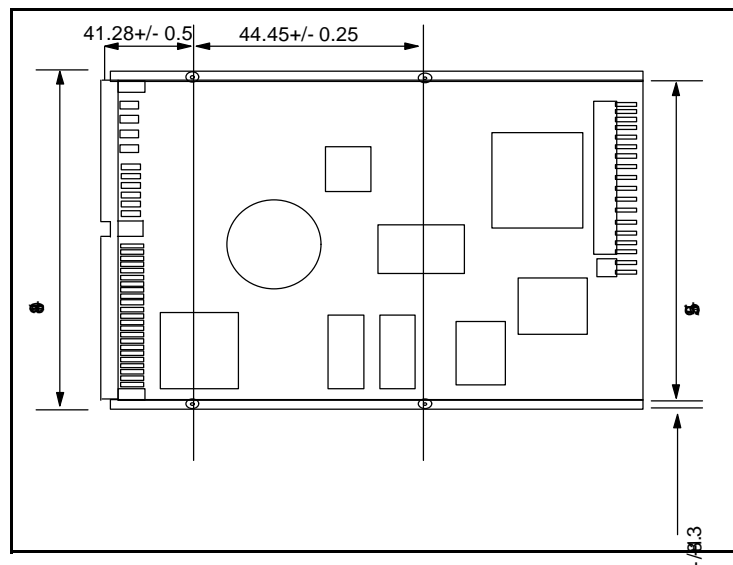
There should be 7mm of clearance between the IBM drives that are mounted with their top sides facing each other. Drives from other manufacturers may require additional spacing due to stray magnetic fields.

For proper cooling it is suggested that a minimum clearance of 7mm be provided under the drive and on top of the drive.

Outline dimensions and mounting hole locations



Side mounting holes



Bottom view



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IBM Hard Disk Drive Technical Support Center

Dept. WCN
3605 Highway 52 North
Rochester, MN 55901
Telephone: 888.IBM.5214 or 507.286.5825
Fax: 507.253.DRIVE
E-mail: drive@us.ibm.com

Singapore Technical Support Center

Telephone: 1800.418.9595 or 65.6.418.9595
E-mail: drive@sg.ibm.com

IBM Storage Systems Division

5600 Cottle Road
San Jose, CA 95193
www.ibm.com/storage

Asia-Pacific Headquarters: 65.320.1234

European Headquarters: 44.01.705.561.871

Japan Sales Branch Office: 81.46645.1039

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Ultrastar 36XP Hardware/Functional Specification, version 1.02

Ultrastar 36XP SCSI Interface Specification, version 1.05

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